



APPENDIX F TO LPC-PA2

INSTRUCTION FOR CLOSURE PLAN AND POST-CLOSURE CARE PLANS FOR PUTRESCIBLE AND CHEMICAL WASTE LANDFILLS

This Appendix sets out the type of information needed in addition to the general information requested in the LPC-PA2 Instructions. You should review Appendices A-G and Section VI of LPC-PA2 form to determine which are applicable to your facility. This Appendix explains the information required in the Closure and Post-Closure Plans.

I. Closure Plan

The closure plan must at a minimum include the following:

- A. A map showing the configuration of the facility after closure of all units, with the following:
 - 1. The contours of the proposed final topography (after placement of the final cover) of all disturbed areas and showing how the final contours blend with the surrounding topography;
 - 2. A scale of 1" = 200' (or greater) and a contour interval of two feet (5 foot or 10 foot contour intervals may be used on slopes steeper than 5:1); and
 - 3. The location of all facility-related structures to remain as permanent features after closure;
- B. Identification of the "assumed closure date" (i.e. the date during the next permit term on which the costs of premature final closure of the facility will be greatest);
- C. Steps necessary for the premature final closure of the site at the assumed closure date;
- D. Steps necessary for the final closure of the site at the end of its intended operating life;
- E. Steps necessary to prevent damage to the environment during temporary suspension of waste acceptance. (This is necessary only if the operator wants a permit which would allow temporary suspension of waste acceptance at the site without initiating final closure.);
- F. A description of the steps necessary to decontaminate equipment during closure;
- G. An estimate of the expected year of closure;
- H. Schedules for the premature and final closure, which shall include, at a minimum:
 - 1. Total time required to close the site; and
 - 2. Time required for closure activities which will allow tracking of the progress of closure; and

- I. A description of methods for compliance with all closure requirements of 35 IAC, Part 811. This will necessitate the following information:
1. Provide estimates of settling rates as they relate to design, construction, and maintenance of the final cover system.
 2. A demonstration (i.e., calculations) that the final slope will have a Static Safety Factor of at least 1.5 and a Seismic Safety Factor of at least 1.3. Both short term (i.e., the design period) and long term (tens or hundreds of years) Safety Factors must be calculated.
 3. Documentation must be provided that shows that the final slope vegetation and other stabilization procedures will meet the following standards:
 - a. All final slopes shall be designed and constructed to a grade capable of supporting vegetation and which minimizes erosion;
 - b. All slopes shall be designed to drain runoff away from the cover and which prevents ponding. No standing water shall be allowed anywhere in or on the unit;
 - c. Vegetation shall be compatible with (i.e. grow and survive under) the local climatic conditions;
 - d. Vegetation shall require little maintenance;
 - e. Vegetation shall consist of a diverse mix of native and introduced species consistent with the post-closure land use; and
 - f. Temporary erosion control measures, including, but not limited to, the application (alone or in combination) of mulch, straw, netting, or chemical soil stabilizers, shall be undertaken while vegetation is being established.
 - g. Vegetation shall be tolerant of the landfill gas expected to be generated;
 - h. The root depth of the vegetation shall not exceed the depth of the final protective cover system; and
 - i. Structures Constructed Over the Unit:
 - i. Structures constructed over the unit must be compatible with the land use;
 - ii. Such structures shall be designed to vent gasses away from the interior; and
 - iii. Such structures must in no way interfere with the operation of a cover system, gas collection system, leachate collection system or any monitoring system.
 4. Final cover must have two layers (i.e. a final protective layer on top of a low permeability layer). The following information must be provided:
 - a. For Final Protective Layer:
 - i. Specification of the thickness of the final cover (minimum: 3 feet);

- ii. A description of the soil including a demonstration that it can support the proposed vegetation;
 - iii. Identification of the source of final cover and a demonstration that the proposed source contains an adequate volume of suitable soil; and
 - iv. A sampling program, based on statistical sampling techniques, that establishes criteria for acceptance or rejection of materials and construction operations to be used in the construction quality assurance program.
 - v. A demonstration that the final protective layer is sufficiently thick to protect the low permeability layer from root penetration and freezing and support the proposed final land use.
 - vi. Assurance that the final protective layer shall be installed soon enough after the low permeability layer is constructed to prevent desiccation, cracking, freezing or other damage to the low permeability layer.
- b. Low Permeability Layer (may be soil, geomembrane or other material):
- i. Design specifications (i.e., material specifications, thickness, hydraulic conductivity, and compaction, if applicable);
 - ii. A demonstration that a low permeability layer meeting the design specifications will also meet or exceed the performance of a compacted soil layer 3 feet thick with a hydraulic conductivity of 1×10^{-7} cm/sec.
 - iii. Identification of the source and a demonstration that the proposed source contains an adequate volume suitable soil (if soil is going to be used to construct the low permeability layer).
 - iv. If the low permeability layer will be a geomembrane, a demonstration that it will have the strength to withstand the stress imposed by the waste stabilization process and a description of the prepared base over which the geomembrane will be placed.
 - v. A description of the construction techniques that will be used in installing the low permeability layer.
 - vi. A description showing how the low permeability layer will tie into the liner system.
 - vii. A sampling program based on statistical sampling techniques and establishing criteria for acceptance or rejection of materials and construction operations to be used in the construction quality assurance program.
5. Calculations demonstrating that all drainage ways and swales have been designed to accommodate runoff from a 100 year, 24-hour precipitation event without scouring or erosion.

II. Post-Closure Care Plan

The post-closure care plan must, at a minimum, include the following:

- A. Descriptions of the inspection and monitoring schedules, the inspections themselves, and the criteria for performing maintenance for the following systems:
 - 1. Final cover.
 - 2. Landfill gas monitoring program.
 - 3. Landfill gas collection and disposal/processing facilities (if proposed).
 - 4. Leachate monitoring, collection and disposal systems.
 - 5. Groundwater monitoring program.
- B. Criteria for reducing the frequency of inspection of the final cover and the frequency of monitoring gas, leachate and groundwater.
- C. Criteria for ceasing to inspect the final cover, ceasing to monitor gas, leachate and groundwater; and ceasing to operate the gas and leachate management systems.

NOTE: If any of the post-closure care information is contained in other reports it may be included in the post-closure care plan by reference.

III. Cost Estimates

The following information must be provided:

- A. Closure Cost
 - 1. The itemized cost of applying final cover to the entire area that will be filled during the period starting at the beginning of the permit term and ending on the assumed closure date.
 - 2. The cost of completing the gas monitoring and collection systems and the runoff control structures.
 - 3. The cost of equipment decontamination.
 - 4. The cost of certification of closure.
- B. Post-Closure Care Cost
 - 1. The itemized cost of carrying out all of the activities described in the post-closure care plan.
 - 2. Calculations determining the present value of providing post-closure care based on the following assumptions:
 - a. Landfill operations will cease on the assumed closure date.

- b. Post-closure care shall continue throughout the remainder of the design period with no reduction in the frequency or stringency of any post-closure care activity except as allowed by 35 IAC 811.111(c)(1)(A).
 - c. The interest rate shall be 4 percent per annum and there shall be no inflation.
3. The present value of the post-closure care cost estimate should be calculated as follows:
- a. Present Worth on the Assumed Closure Date of Annual Costs Based on First of the Year Payments

$$P_1 = A + A \frac{(1+i)^n - 1}{i(1+i)^n}$$

Where: P_1 = Present Worth on the Assumed Closure Date

A = Annual Cost of Post-Closure Care

i = Interest Rate = 4% = 0.04

n = Number of Years in the Post-Closure Care Period -1

Note: If the assumed closure date is within one (1) year of the present, P_1 is the Post-Closure Cost Estimate. If the assumed closure date is more than one (1) year from the present, go on to the next step.

- b. Current Present Worth

$$P_2 = F \frac{1}{(1+i)^N}$$

Where: P_2 = Current Present Worth

F = Present Worth on Assumed Closure Date = P_1

i = Interest Rate = 4% = 0.04

N = Number of Years from Assumed Closure Date to Present -1

- c. Example

Let's calculate the present value of the post-closure care cost estimate for a situation in which the annual cost estimate for post-closure care is \$50,000/year; the post-closure care period is 30 years; and the assumed closure date is 4 years, 6 months from the present.

i. Step 1

$$P_1 = 50,000 + 50,000 \frac{(1 + 0.04)^{29} - 1}{0.04 (1 + 0.04)^{29}}$$

$$P_1 = \$899,186.00$$

ii. Step 2

$$P_2 = 899,186.00 \frac{1}{(1 + 0.04)^{3.5}}$$

$$P_2 = \$783,850.00$$

4. If the reduction described in Step 3(b) is used (and a permit is issued), the permit letter will include a schedule requiring the operator to post additional financial assurance on the anniversary of the date that the permit is issued. This will be done until the amount of financial assurance reaches the P_1 , value calculated in Step 3(a). Using the situation given in 3c., the schedule would be as shown in the table on the next page.

<u>Date for Post-Closure Care*</u>	<u>Amount of Financial Assurance Required</u>
Day Permit is Issued #	\$783,850
First Anniversary	\$815,204
Second Anniversary	\$847,812
Third Anniversary	\$881,725
Fourth Anniversary	\$899,186

* Financial Assurance is also required for closure. However, since the closure cost estimate is not reduced to its present value, an annual adjustment is not needed.

Financial Assurance does not need to be posted with the Agency until the Significant Modification to Obtain Operating Authorization has been submitted. Nevertheless, the day, that the permit approving development of the facility to 35 IAC 811 and 812 (and 814 for existing facilities) standards is issued, shall be the anniversary date for adjusting the post-closure care financial assurance.

C. Sum of the Closure Cost Plus the Present Value of the Post-Closure Cost.

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